INTEGRATED TOUCH PAINT SYSTEM FOR DISPLAYS

BACKGROUND OF THE INVENTION

The invention relates generally to touch panel display systems and more particularly, to sealing light beam touch panel systems against electromagnetic energy interference.

Patents disclosing such touch panel display systems include U.S. Pat. No. 3,764,813 to Clement et al. granted Oct. 9, 1973; U.S. Pat. No. 3,775,560 to Ebeling et al. granted Nov. 27, 1973; and U.S. Pat. No. 4,198,623 to Misek et al. granted Apr. 15, 1980. In systems such as these where light beam sources direct beams of light across the face of a display toward light beam detectors located on the other side of the display, electromagnetic energy may escape from the display unit and allow its detection and it may also interfere with sensitive electronic equipment in the immediate area. Also, external electromagnetic energy may enter the display unit and interfere with its operation. Prior electromagnetic energy shielding arrangements for touch panel display units have been complex, bulky, and have not been sufficiently integrated with the display unit. These prior arrangements have in some cases made maintenance of the display unit more difficult and have typically not been of the type which also enhance display operations.

Various internal touch panel circuits as well as various display circuits generate signals which may radiate from the display unit. Where square wave signals are used inside the display unit, harmonics of relatively high frequency may escape. Where the touch panel display unit is to be used in an environment requiring the control of compromising emanations, suppressing the radiation of such signals may be required in order to avoid detection. In the case where the display unit is located near other equipment which radiates electromagnetic energy, such as a radar system, exposure of the display unit circuits to that energy may cause faults, processing errors or have other detrimental effects on display unit operation. As used herein, electromagnetic energy interference refers to signals which are of lower frequency than that of the touch panel light beams.

Accordingly, it is an object of the invention to provide an improved, integrated electromagnetic energy interference sealing arrangement for a light beam touch panel display system.

It is also an object of the invention to provide an integrated, electromagnetic energy interference shielding touch panel system that provides shielding in combination with certain other features to result in a simpler, lower cost, operator adapted touch panel system for displays.

It is also an object of the invention to provide an integrated touch panel system which enhances display viewing, enhances operator/touch panel interaction, and facilitates maintenance.

It is also an object of the invention to provide a touch panel system which, along with electromagnetic energy shielding arrangements, is integrated into a front panel bezel which permits easier disassembly and maintenance.

SUMMARY OF THE INVENTION

The foregoing objects and other objects are attained by the invention wherein there is provided a light beam touch panel system which includes an electrically conductive bezel disposed around the display periphery which would typically be mounted at the front of an electrically conductive display outer enclosure. The outer enclosure surrounds the display apparatus at its back, top, bottom, and sides and in accordance with the invention, it is mounted in electrical contact with the electrically conductive bezel which is mounted around the front of the display so that an electrically conductive path is provided for shielding the display unit against electromagnetic energy interference. Over the display screen is placed an optically transparent, electrically conductive faceplate through which the display is viewed. Around the faceplate and in contact with the bezel is a raised border which defines the active area of the touch panel. In addition, a seal is provided by means of the border or in association with the border which completes an electrical path between the faceplate and the electrically conductive bezel. The seal is transparent to the light beams of the touch panel which are directed through it. The bezel, faceplate and seal are used for sealing against the passage of electromagnetic energy interference out of the display unit and into the display unit as well as for other features discussed herein.

The faceplate provides electromagnetic energy interference shielding across the front of the display. Shielding by the faceplate is provided by means including an embedded electrically conductive mesh; an optically transparent, electrically conductive film placed coextensively with the faceplate; or forming the faceplate from electrically conductive material such as leaded glass. When numerous and thin, dark colored or black wires are used for the faceplate mesh, the mesh will be practically invisible to the operator but will intercept and shade the display from ambient illumination such as from ceiling lights in a manner similar to the function of a venetian blind. Also, where numerous and thin, dark colored or black wires are used, the faceplate acts as a neutral density filter achieving its shading and electromagnetic energy interference shielding function without distorting the colors of a color display. In accordance with another aspect of the invention, the surface of the faceplate is roughened for further display viewing enhancement. This roughening disperses reflections and masks oil and fingerprints thereby enhancing operator use. Also, the curvature of a cathode ray tube screen is compensated for by using a flat faceplate since it provides the operator with a uniform active area for using the touch panel.

As discussed above, the seal is used to complete the electrical path between the faceplate and the electrically conductive bezel. Means for implementing the seal include: (1) attaching the wire mesh of the faceplate across it or embedding the wire mesh in it to make direct contact with the bezel; (2) applying an optically transparent, electrically conductive film to it and in contact with the faceplate wire mesh or film and with the bezel to complete the electrical path; (3) attaching the electrically conductive film of the faceplate to it and in contact with the bezel; or (4) forming the seal from an electrically conductive material.

The raised border and associated seal are also disposed at an obtuse angle to the faceplate so that light striking the border/seal combination from light beam sources, particularly those located at the touch panel edges, will be reflected away from the associated light beam detector and will not circumvent an interrupting object. This configuration decreases the need for the